Notice of Allowability	Application No.	Applicant(s)
	10/705,562	MCELHINNEY, GRAHAM
	Examiner	Art Unit
	Victor J. Taylor	2863

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *09 June 2003*.

2. ☒ The allowed claim(s) is/are *1-66*.

3. ☒ The drawings filed on *11 November 2003* are accepted by the Examiner.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 12
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

Drawings

1. The drawings were received on 11 November 2003. These drawings are approved.

Prior Art

2. The prior art made of record and not relied upon is considered pertinent to applicant.

I. Art A of Kuckes US 5,589,775 in class 324/346 is cited for the method of rotating magnets for the distance and the direction measurements from a first borehole to a second borehole using the measurements in a first borehole and the measurements from a second borehole 42 in figure 1. He further teaches the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2 and discloses the X and Y vector Azimuthal direction in figure 3. He further the two axis fluxgate 34 inside the pipe in figure 5 and discloses the twinning drill line 98 to the cased borehole 34 in figure 8 and discloses the magnetic field source and magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components with computational equations used to determine magnetic fields and the phase angles between the fields in line 64 and in lines 5-66 in column 6.

II. Art B of Kuckes US 5,305,212 in class 702/007 is cited for the sensing apparatus and method of magnetic field gradient measurement for distance and

direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well hence the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations and the Taylor series expansion to provided the distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Allowable Subject Matter

3. Claims 1-20, 22-26 and 28-66 are allowed.

4. The following is an examiner's statement of reasons for allowance:

The method and apparatus for techniques in well twinning used in borehole surveying with magnetic field measurements with steps for determining the magnetic interference vectors using at least two sensor positions in the borehole with steps for comparing the measured magnetic fields at the positions with a known magnetic field of the earth using the claimed combination of limitation sets is not found in the cited art of record.

I. The method in claim 1 for performing a survey of a borehole with method step limitations for "providing a downhole tool including first and second magnetic field measurement devices disposed at corresponding first and second positions in the borehole; the first and second positions selected to be within sensory range of magnetic

flux from a target subterranean structure"...[and] with steps for "measuring local magnetic fields at the first and second positions using the corresponding first and second magnetic field measurement devices"...[and in combination with] the steps for "processing (1) the local magnetic fields at the first and second positions, and (2) a reference magnetic field, to determine a portion of the local magnetic fields attributable to the target subterranean structure"...[and] in combination with the step for "generating interference magnetic field vectors at the first and second positions from the portion of the local magnetic fields attributable to the target subterranean structure"...[and] with the steps for "processing the interference magnetic field vectors to determine a tool face to target angle at each of the first and second positions, the tool face to target angles representing a corresponding direction from each of the first and second positions to the target subterranean structure" ...[and/or] in combination with the particularly claimed steps wherein the step for "processing the tool face to the target angles at the first and second positions to estimate a local change in direction of the borehole relative to the target subterranean structure" to process the first and second magnetic data to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record..

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by

the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the magnetic field source and the magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claims 2-20 and 22-25 are dependent on the allowed independent claim 1 and are allowed at least for the reasons cited above.

II. The method in claim 26 for performing a survey of a borehole with method step limitations for "providing a downhole tool including a magnetic field measurement device disposed at a first position in the borehole, the first position selected to be within sensory range of magnetic flux from the subterranean structure"...[and] with steps for "measuring a local magnetic field at the first position using the magnetic field measurement device"...[and in combination with] the steps for "re-positioning the tool at a second position in the borehole so that the magnetic field measurement device remains within sensory range of the magnetic flux from the subterranean structure"...[and] in combination with the step for "measuring a local magnetic field at the second position using the magnetic field measurement device"...[and] with the step for "processing the local magnetic fields at the first and second positions and a reference magnetic field to determine a portion of the local magnetic fields attributable to the target subterranean structure"...[and] with steps for "generating interference magnetic field vectors at the first and second positions from the portion of the local magnetic fields attributable to the target subterranean structure"...[and] with the steps for (g) of "processing the interference magnetic field vectors to determine a tool face to target angle at each of the first and second positions, the tool face to target angles representing a corresponding direction from each of the first and second positions to the target subterranean structure" ...[and/or] in combination with the particularly claimed steps wherein the step for "processing the tool face to target angles determined in step

(g) to determine a distance from at least one of the first and second positions in the borehole to the target subterranean structure" to process the first and second magnetic data to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record..

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the magnetic field source and the magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence

teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claims 28-29 are dependent on the allowed independent claim 26 and are allowed at least for the reasons cited above.

III. The method in claim 30 for determining a distance from a borehole to a target subterranean structure with steps for "providing a downhole tool including first and second magnetic field measurement devices disposed at corresponding first and second positions in the borehole, the first and second positions selected to be within sensory range of magnetic flux from the target subterranean structure"...[and] with steps for "measuring local magnetic fields at the first and second positions using the corresponding first and second magnetic field measurement devices"...[and in combination with] the steps for "processing (1) the local magnetic fields at the first and second positions, and (2) a reference magnetic field, to determine a portion of the local magnetic fields attributable to the target subterranean structure"...[and] in combination with the step for "generating interference magnetic field vectors at the first and second

positions from the portion of the local magnetic fields attributable to the target subterranean structure"...[and] with the step for "processing the interference magnetic field vectors to determine a tool face to target angle at each of the first and second positions"...[and/or] in combination with the particularly claimed steps wherein the step for "processing the tool face to target angles at the first and second positions to determining the distance from the borehole to the subterranean structure" to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record.

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the magnetic field source and the magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claims 31-42 are dependent on the allowed independent claim 30 and are allowed at least for the reasons cited above.

IV. The method in claim 43 for determining a local azimuth of a borehole with steps for providing a downhole tool including first and second magnetic field measurement devices disposed at corresponding first and second positions in the borehole, the first and second positions selected to be within sensory range of magnetic flux from a target subterranean structure ""...[and] with steps for "measuring local magnetic fields at the first and second positions using the corresponding first and

second magnetic field measurement devices"...[and in combination with] the steps for "processing (1) the local magnetic fields at the first and second positions, and (2) a reference magnetic field, to determine a portion of the local magnetic fields attributable to the target subterranean structure"...[and] in combination with the step for "generating interference magnetic field vectors at the first and second positions from the portion of the local magnetic fields attributable to the target subterranean structure"...[and] with the step for "processing the interference magnetic field vectors to determine a tool face to target angle at each of the first and second positions"...[and/or] in combination with the particularly claimed steps wherein the step for "processing the tool face to target angles at the first and second positions to determine a local azimuth of the borehole" to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record.

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the magnetic field source and the magnetic field sensor 36 and teaches the magnetic field

vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claims 44-46 are dependent on the allowed independent claim 43 and are allowed at least for the reasons cited above.

V. The method in claim 47 for drilling a borehole along a predetermined course relative to a target subterranean structure with at least a portion of the borehole being within sensory range of magnetic flux from the target subterranean structure with steps

for "providing a downhole tool including first and second magnetic field measurement devices disposed at corresponding first and second positions in the borehole, the first and second positions selected to be within sensory range of magnetic flux from the target subterranean structure"...[and] with steps for "measuring local magnetic fields at the first and second positions using the corresponding first and second magnetic field measurement devices"...[and in combination with] the steps for "processing (1) the local magnetic fields at the first and second positions, and (2) a reference magnetic field, to determine a portion of the local magnetic fields attributable to the subterranean target well"...[and] in combination with the step for "generating interference magnetic field vectors at the first and second positions from the portion of the local magnetic fields attributable to the target subterranean target well"...[and] with the step for "processing the interference magnetic field vectors to determine a tool face to target angle at each of the first and second positions"...[and] with steps for "processing the tool face to target angles at the first and second positions determined in (e) to determine a direction for subsequent drilling of the borehole"...[and] with the steps for "drilling the borehole along the direction for subsequent drilling determined in (f) such that the downhole tool is repositioned at a new locus in the borehole, and the first and second positions are repositioned at corresponding new loci, the first and second magnetic field measurement devices remaining within sensory range of magnetic flux from the subterranean structure" ...[and/or] in combination with the particularly claimed steps wherein the step for "processing the tool face to target angles at the first and second positions to determining the distance from the borehole to the subterranean

structure"...[and] with "repeating (b), (c), (d), (e), (f), and (g)" to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record.

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the magnetic field source and the magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1.

He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claims 44-46 are dependent on the allowed independent claim 47 and are allowed at least for the reasons cited above.

VI. The system in claim 52 for determining the location of a target subterranean structure from within an adjacent borehole and the subterranean structure generating magnetic flux with the system containing apparatus for a down hole tool including first and second magnetic field measurement devices deployed thereon, and the tool operable to be positioned in a borehole such that the first and second magnetic field measurement devices are located at corresponding first and second positions in the borehole, with the first and second positions selected to be within the sensory range of the magnetic flux from the subterranean structure and a processor configured with "local magnetic fields at the first and second positions as measured using the corresponding first and second magnetic field measurement devices"...[and] with "a portion of the local magnetic fields attributable to the subterranean structure at each of the first and second positions, said portion determined from the local magnetic fields in (A) and a reference

magnetic field made available to the processor"...[and in combination with] the "interference magnetic field vector at each of the first and second positions, each of the interference magnetic field vectors corresponding to the portion of the local magnetic fields determined in (B)...[and/or] in combination with the particularly claimed steps wherein the step for "a tool face to target angle at each of the first and second positions, the tool face to target angles representing a corresponding direction from first and second positions in the borehole to the subterranean structure" and "a local change in direction of the borehole relative to the target subterranean structure" to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record.

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the magnetic field source and the magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field

components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claims 53-54 are dependent on the allowed independent claim 52 and are allowed at least for the reasons cited above.

VII. The computer system in claim 55 at least one processor and a storage device having computer-readable logic stored thereon with the computer-readable logic accessible by and intelligible to the processor and the processor further disposed to receive input from first and second magnetic field measurement devices when said first

and second magnetic field measurement devices are deployed on a downhole tool at corresponding first and second positions in a borehole and with the first and second positions selected to be within sensory range of magnetic flux generated by a target subterranean structure located outside the borehole. The computer-readable logic further configured to instruct the processor to execute a method for determining the location of the target subterranean structure by execution of steps to "determining a local magnetic field at each of the first and second positions based on input from the corresponding first and second magnetic field measurement devices"...[and] with steps for "determining a portion of the local magnetic field attributable to the subterranean structure at each of the first and second positions, said portion determined from the local magnetic fields in (a) and a reference magnetic field made available to the processor"...[and in combination with] the steps for "calculating an interference magnetic field vector for each of the first and second positions, each of the interference magnetic field vectors corresponding to the portion of the local magnetic fields determined in step (b"...[and/or] in combination with the particularly claimed steps wherein the step for "determining tool face to target angles at each of the first and second positions, the tool face to target angles representing a corresponding direction between the first and second positions in the borehole to the subterranean structure " and "processing the tool face to target angles at the first and second positions to estimate a local change in direction of the borehole relative to the target subterranean structure" to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record.

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the magnetic field source and the magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and

computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claims 56-64 are dependent on the allowed independent claim 55 and are allowed at least for the reasons cited above.

VIII. The method in claim 65 for a computer system with computational apparatus with at least one processor and a storage device having computer-readable logic stored thereon, the computer-readable logic accessible by and intelligible to the processor with "the processor further disposed to receive input from first and second magnetic field measurement devices when said first and second magnetic field measurement devices are deployed on a downhole tool at corresponding first and second positions in a borehole,"...[and] with "the first and second positions selected to be within sensory range of magnetic flux generated by a target subterranean structure located outside the borehole"...[and] with "the computer-readable logic further configured to instruct the processor to execute a method for determining the location of the target subterranean structure"...[and] in combination with the processing steps for "determining a local magnetic field at each of the first and second positions based on input from the corresponding first and second magnetic field measurement devices"...[and] with the step for "determining a local magnetic field at each of the first and second positions

based on input from the corresponding first and second magnetic field measurement devices"...[and] with steps for "determining a portion of the local magnetic field attributable to the subterranean structure at each of the first and second positions, said portion determined from the local magnetic fields in step (a) and a reference magnetic field made available to the processor"...[and] with the steps for "calculating an interference magnetic field vector for each of the first and second positions, each of the interference magnetic field vectors corresponding to the portion of the local magnetic fields determined in step (b)" ...[and/or] in combination with the particularly claimed steps wherein the step for "determining tool face to target angles at each of the first and second positions, the tool face to target angles representing a corresponding direction between the first and second positions in the borehole to the subterranean structure" to produce the survey of the borehole and produce the twinning of the wellbore is not found in the cited art of record.

The prior Art A of Kuckes a method of rotating magnet data measurements for the distance and the direction measurements from a first borehole to a second borehole. He teaches using the measurements in the first borehole and the measurements from the second borehole 42 in figure 1. He further teaches computational processes computing the magnetic direction field in the Elliptical path by the field vector 66 from the centroid observation point 44 in figure 2. He further teaches the X and Y vector Azimuthal direction in figure 3. He further teaches using sensors of the two-axis fluxgate 34 types inside the pipe in figure 5. He further discloses the twinning drill line 98 to the cased borehole 34 in figure 8. He further discloses the

magnetic field source and the magnetic field sensor 36 and teaches the magnetic field vectors in lines 35-60 of column 4. He further teaches the electromagnetic field components computed with the computational equations and used to determine the magnetic fields and the phase angles between the fields in lines 5-66 in column 6.

The prior Art B of Kuckes teaches the method of magnetic field gradient measurement for distance and direction determination utilizing the fluxgate magnetometers 24 responsive to the target well 10 in figure 1. He further teaches the target well 10 with the steel casing 12 intercepted by the relief well 14 and further teaches the wells straight and drilled parallel to the target original well and hence teaches the twinning of oil wells in lines 10-20 of column 3 and as illustrated in figure 1. He further teaches the use of equations particularly the Taylor series expansion to provided the computed distance R from the relief twin well to the target well and computes the angle A between the azimuthal orientation in lines 1-60 of column 8. He further discloses the computations performed in the computer 90 in lines 40 columns 9.

Therefore the prior art A of Kuckes, and The prior art B of Kuckes in combination or alone does not teach the present limitation of the claimed combination limitation.

It is these limitations expressed in each of these claims and not found, taught, or suggested in the prior art of record, that makes these claims allowable over the prior art.

Claim 66 is dependent on the allowed independent claim 65 and is allowed at least for the reasons cited above.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Victor J. Taylor whose telephone number is 517-272-2281. The examiner can normally be reached on 8:00 to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E. Barlow can be reached on 571-272-2863. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

VJT
3 June 2005

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